Wilmington Model Development Steps

Finalize Highway Network (this step should be done iterative with TAZ step)

1. Edit line work to reflect only roadways that will be modeled.
2. Reach agreement on modeled roadways.
3. Clean line work to prepare for building and skimming the network.
   - Connectivity checks and edits
   - Simplify to minimize number of links
   - Cleaning line work so that interstates/freeways can be dualized
   - Creating interchanges at appropriate locations
   - Setting one way links for one way pairs
4. Standardize data table for data entry of highway attribute data.
   - Agreement should be reached on highway attributes to be coded
5. Collect, code, and/or verify attribute data.
   - Many data elements can be extracted from previous model
   - Remaining data elements will need to be field collected
   - All data will need to be coded to appropriate roadway link
   - All data elements will need to be verified by local staff
6. Add centroid connector links.
7. Code centroid connector data.
8. Error check highway network.

Finalize Regional Traffic Analysis Zones (this step should be done iterative with Highway Network step)

1. All SE data will be coded to the existing traffic analysis zones.
2. For the model, some zones may need to be either split or aggregated. For aggregated zones the data aggregation can be handled through TransCAD. For zones requiring a split, local assistance will be needed for the allocation of SE data to the new zone structure. Decisions regarding zone aggregations or splits will follow the guidance provided below.
   - Zones will vary in size depending on the density and nature of development
   - The smallest zones should be in the CBD or other densely developed areas, larger zones should be in the more rural undeveloped areas
   - The size of the zones will reflect the level of analysis desired
   - The number of trips generated by each zone should be relatively equal and the total trips generated by any one zone should be less than 10 – 15 thousand
   - The density across the zone should be relatively even
   - IMPORTANT: When determining the appropriate zone configuration, their comparability with the transportation network is essential. Consideration should be given to how the traffic from the zone will load to the network. As a general rule of thumb, the network should form the boundaries of the zones.

**Reliable data sources for model parameters, validation, and reasonableness checking: Calibration and Adjustment of System Planning Models, FHWA, Dec 1990; Model Validation and Reasonableness Checking Manual, TMIP, USDOT, EPA, June 2001;*

SE Disaggregate Submodel (if cross-classification is used)

1. Determine which variables will be used for the trip production model (household size and auto ownership recommended.)
2. Extract this data from the Census Transportation Planning Package (CTPP)
3. Estimate the household size distribution for each zone based on the average persons per household for the zone. Initial estimates should be adjusted as necessary so that the totals for each category match the regional distribution for household size.
4. Estimate the auto ownership distribution for each zone based on the average autos owned per household for the zone. The initial estimates should be adjusted as necessary so that the totals for each category match the regional distribution for auto ownership.
5. Apply the joint distribution table to the households by size for each zone derived in Step 3.
6. For each zone, perform matrix balancing to ensure that the total number of households by size in each auto ownership category matches the control totals from Step 3.

Internal Trip Production Model

1. Define trip purposes:
   - Home Based Work (HBW)
   - Home Based Other (HBO)
   - Home Based Shopping (HBSH)
   - Non - Home Based (NHB)
2. Summarize trips by purpose and households.
3. Append trips, by purpose, to the household file.
4. Define cross-classification categories for household size, auto ownership, and DU class levels. (30 observations per cell)
5. Collapse/combine cross-classification categories when the sample means are not statistically different from one another. (students T Test)
6. Resulting means are trip rates per cell for trip production model.
7. Check for reasonableness and validate. *

Internal Trip Attraction Models

1. Expand survey data to universe.
2. Apply trip purpose definition.
3. Define districts.
4. Combine, at district level, socioeconomic data and trip attractions.
5. Perform regression analysis.
6. Select best fit equation.
7. Run validation checks.
8. Allocate constant to independent variables.
9. Check for reasonableness and validate. *

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Calculate NHB Trips for Non-Residents

1. Calculate NHB trips for non-residents and add to NHB trip purpose.

Balance Internal Productions and Attractions

1. After all performance checks have been made and documented, balance productions and attractions to productions for all home-based trips and balance to attractions for non-home based trips.

Internal Trip Distribution - Free Flow

1. Calculate free-flow highway travel times (zone to zone impedance - minimum free flow travel time.)
2. Add intrazonal time to step 1.
3. Add terminal times to step 2.
4. Calculate observed trip tables by purpose.
5. Summarize frequency of observed trips by minute of travel time and average travel time by trip purpose.
6. Select initial gamma function parameters for each trip purpose. *
7. Run gravity model with initial gamma functions, productions and attractions, and free flow highway skim.
8. Check average trip length by trip purpose and trip length distribution curve for reasonableness. *
9. Adjust gamma function as needed and rerun gravity model.
10. Repeat process until average trip length by trip purpose and trip length distribution curves are within reasonable standards. *

Time of Day Factors

1. Summarize auto trips by trip purpose and trip start time in half-hour increments.
2. Determine peak periods and off-peak periods using survey data and hourly traffic count data.
3. Calculate, by purpose, the percent of traffic in each peak period.
4. Calculate, by purpose, by period, directional split of trips.
5. Apply time of day and directional split factors to twenty four hour trip tables to develop three assignment trip tables for each trip purpose (AM peak, PM peak, and Off-peak).
6. Estimate, by peak period, the percent of traffic occurring within the peak hour.
7. Apply factor from previous step to the volume in the BPR formula within the volume/delay functions.

External Station Analysis (steps are similar to steps applied for internal trip purposes)

1. Data file preparation for external station traffic counts.
   - Allocate all non-modeled roadway counts to neighboring modeled roadway.
   - From survey identify percent through and remaining IX trips.
   - May also want to separate autos and commercial vehicles if data is robust enough.

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2. Build through trip tables.
3. Develop IX attraction equations.
   - Expand survey data to universe.
   - Apply trip purpose definition.
   - Define districts.
   - Combine, at district level, socioeconomic data and trip attractions.
   - Perform regression analysis.
   - Select best fit equation.
   - Run validation checks.
   - Allocate constant to independent variables.
   - Check for reasonableness and validate. *
4. IX trip tables (using free flow skims calculated previously)
   - Calculate observed trip tables by purpose.
   - Summarize frequency of observed trips by minute of travel time and average travel time by trip purpose.
   - Select initial gamma function parameters for each trip purpose. *
   - Run gravity model with initial gamma functions, productions and attractions, and free flow highway skim.
   - Check average trip length by trip purpose and trip length distribution curve for reasonableness. *
   - Adjust gamma function as needed and rerun gravity model.
   - Repeat process until average trip length by trip purpose and trip length distribution curves are within reasonable standards. *
5. Use external station survey to develop and apply time of day factors to the through trip tables and IX trip tables.
   - Summarize auto trips by trip purpose and trip start time in half-hour increments.
   - Determine peak periods and off-peak periods using survey data and hourly traffic count data.
   - Calculate, by purpose, the percent of traffic in each peak period.
   - Calculate, by purpose, by period, directional split of trips.
   - Apply time of day and directional split factors to twenty four hour trip tables to develop three assignment trip tables for each trip purpose (AM peak, PM peak, and Off-peak).
   - Estimate, by peak period, the percent of traffic occurring within the peak hour.
   - Apply factor from previous step to the volume in the BPR formula within the volume/delay functions.
6. Through trips and IX trips will be assigned with other trip tables and assignment validated after final congested feedback loop is complete.

Commercial Vehicle Analysis (steps are similar to steps applied for internal trip purposes)

1. Create truck trip purposes.
2. Develop commercial vehicle production and attraction models (borrow from Triangle).
3. Apply production and attraction models and validate results. *

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4. Develop uncongested highway skims (completed in previous step).
5. Calibrate trip attraction model by trip purpose.
6. Check average trip length and trip length distribution curve for reasonableness. *
7. Develop and apply time of day factors to the commercial vehicle trip tables (borrow or use survey data).
8. Commercial vehicles will be assigned with other trip tables and assignment validated after final congested feedback loop is complete.

A.M. Assignment

1. Perform AM Stochastic User Equilibrium assignment for AM peak-period auto trips.

Trip Distribution – Congested

1. Calculate congested highway travel times using AM loaded highway network.
2. Select initial gamma function parameters for each trip purpose. *
3. Run gravity model with initial gamma functions.
4. Check average trip length by trip purpose and trip length distribution curve for reasonableness. *
5. Adjust gamma function as needed and rerun gravity model.
6. Repeat process until average trip length by trip purpose and trip length distribution curves are within reasonable standards.

Final Highway Assignment

1. Perform Stochastic User Equilibrium assignment for AM peak-period auto trips, PM peak-period auto trips, and Off-peak auto trips.
2. Validate final highway assignment using performance measures specified in model specifications. Validation checks should first be made globally, then regionally, then by facility type, and then by individual link. Calibration is an iterative process. Cycle back through overall model steps until an acceptable level of calibration is achieved. *

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